TRUNK PROCESSOR AND ALARM (TPA) UNIT, 628030

GENERAL DESCRIPTION

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1. GENERAL

1.01 This Section provides a general description of the ITT D448 trunk processor and alarm (TPA) unit, 628030 (Fig. 1), to the functional block diagram level.

1.02 This Section has been reissued to include information on the handling of NMOS-equipped units.

1.03 The unit senses system alarm conditions, and, during alarm conditions, generates control signals to release connections, terminate toll service charges, and prevent access by switching equipment. The front panel of the unit displays visual indications to assist maintenance personnel in isolating the cause of a carrier group alarm (CGA).

2. DESCRIPTION

2.01 The unit mounts in the D448 multiplex shelf (common equipment mounting section). In Mode 1, one unit mounts in connector J11C; in Modes 2, 3, and 4, one unit mounts in connector J11C (for Digroup A) and one in connector J15C (for Digroup B). Installation procedures for the unit are provided in Section ITTR-18-431 (for Mode 1 operation), ITTR-18-432 (for Mode 2 operation), or ITTR-18-433 (for Mode 3 operation).

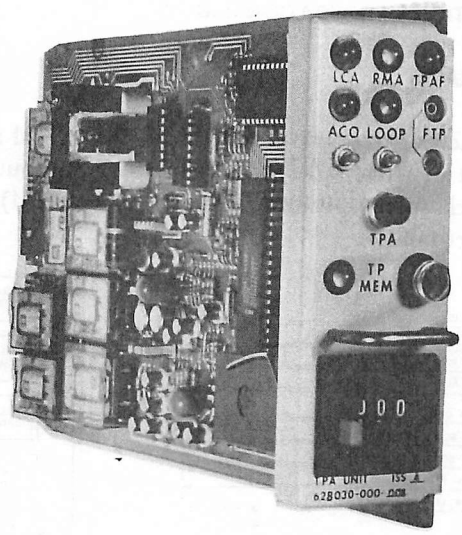


Fig. 1—TPA Unit, 628030

2.02 The unit is available in two groups. Group -0 is equipped with a CGA counter on the front panel, while Group -1 is not. Group -0 is identified by the mnemonic TPA/C; Group -1 is identified by the mnemonic TPA.

2.03 The unit consists of an epoxy-glass printed circuit board (PCB) and associated circuit components. The front panel of the unit is fitted with an extraction handle which facilitates removal of the unit from the shelf. Identification on the front panel indicates the unit mnemonic (TPA/C or TPA), part number, and issue letter. The part number and issue letter are also located on the noncomponent side of the PCB directly behind the front panel.

2.04 The LOOP, TP MEM, ACO, LCA, RMA, and TPAF LEDs (DS1 through DS6, respectively); the TPA lamp (DS7); the ACO, TP MEM, and LOOP pushbutton switches (S1 through S3, respectively); the FTP test points (TP1 and TP2); and the CGA counter (Group -0 only) are located on the front panel of the unit.

2.05 Printed circuit wiring is etched on both sides of the PCB. The unit inputs and outputs are terminated in gold-plated contacts on the rear edge of the PCB. These contacts mate with a 70-pin contact edge connector on the rear of the multiplex shelf.

3. FUNCTIONAL OPERATION (FIG. 2)

LOCAL ALARM

3.01 The unit recognizes four sources of a local alarm: (1) an active $\overline{\text{LCA}}$ bus; (2) an active card out loop, (3) pin jacks inserted in the FTP test points; and (4) a TPA unit power failure.

3.02 An active $\overline{\text{LCA}}$ bus is caused by a loss of PCM, framing losses detected by the receive logic unit (RLU), or a system power failure detected by the power converter unit (PCU).

3.03 An active card out loop is signaled to the unit on the common card out (CCO) lead, the system card out (SCO) same system lead, or the SCO other system lead. In Mode 1, an active SCO same system lead indicates that the TLU or RLU for Digroup A or LI-1 has been removed and an active SCO other system lead indicates that the TLU or RLU for Digroup B has been removed. The SCO other system lead is monitored only in Mode 1. In Modes 2, 3 and 4, the SCO same system lead monitors the

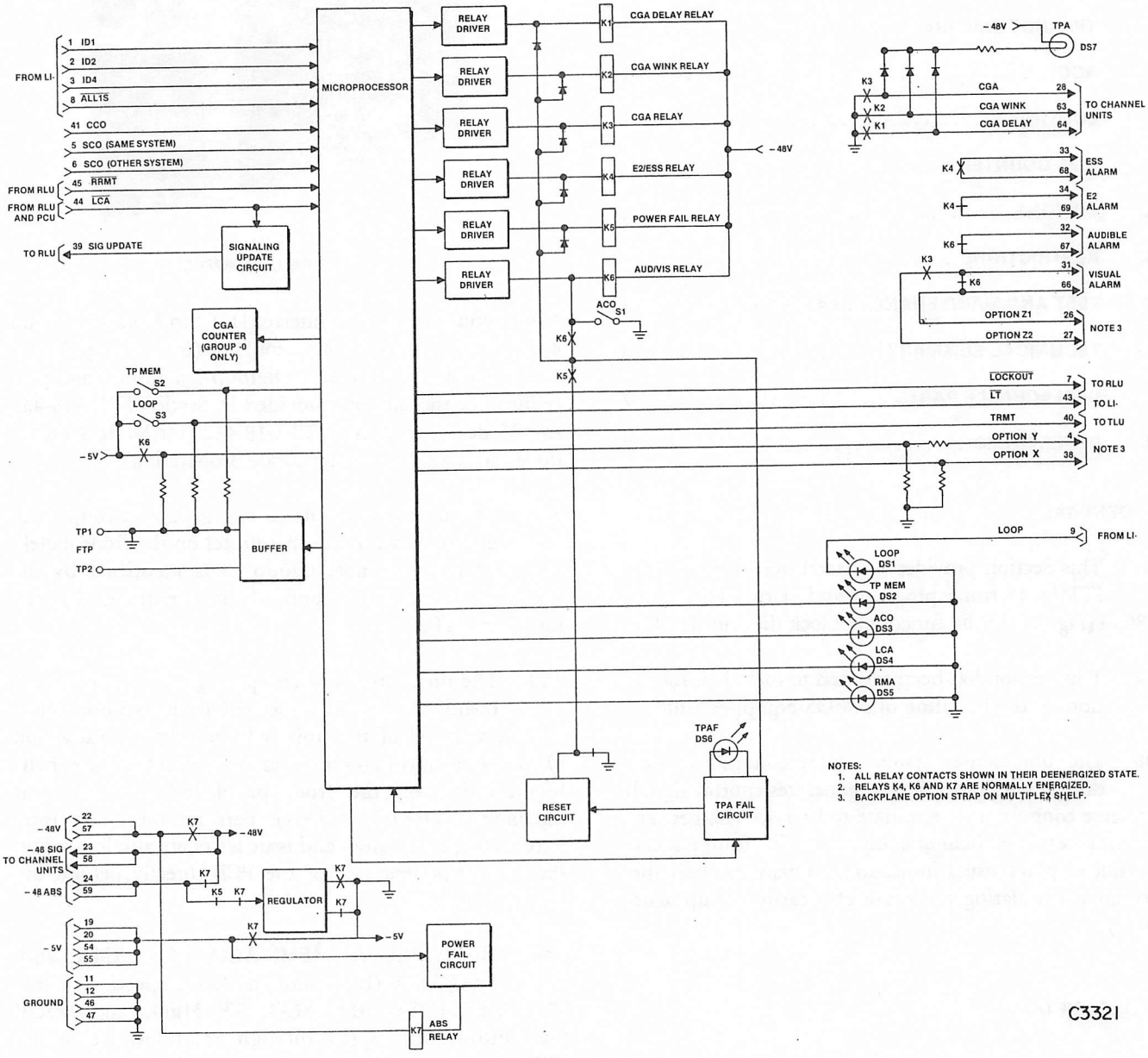
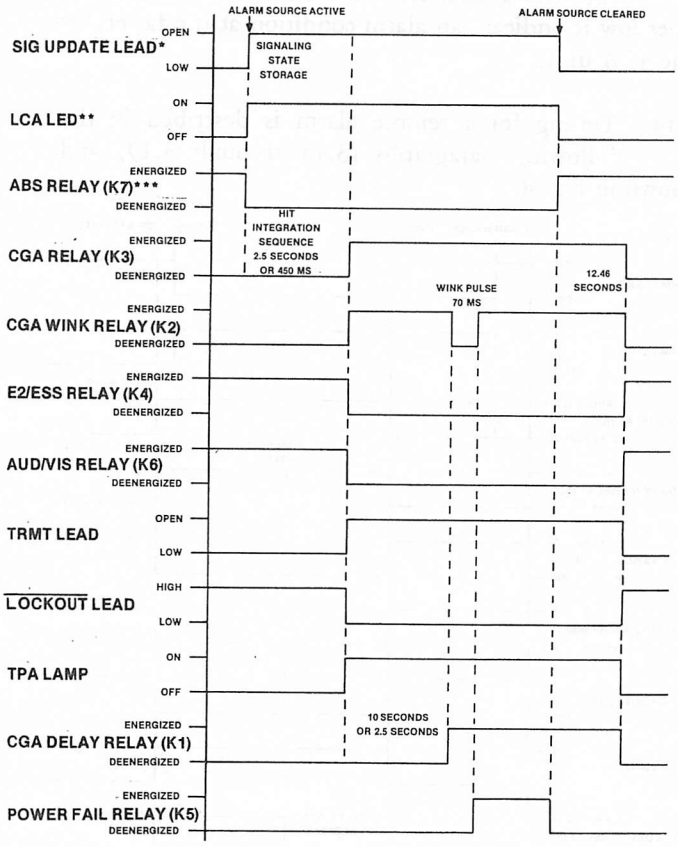


Fig. 2—TPA Unit, 628030, Functional Block Diagram

TLU or RLU of the digroup with which the TPA unit is associated and the LI-.

3.04 Timing for a local alarm is described in the following paragraphs (3.05 through 3.12) and shown in Fig. 3.



*FUNCTIONAL ONLY WHEN LCA BUS IS ACTIVE.
**FUNCTIONAL ONLY DURING NON-TPA UNIT POWER FAIL ALARMS.
***FUNCTIONAL ONLY DURING TPA UNIT POWER FAIL ALARMS.

Fig. 3—Local Alarm Timing

3.05 When the $\overline{\text{LCA}}$ bus becomes active, the SIG UPDATE lead to the RLU is opened, which initiates signaling state storage. During signaling state storage, the signaling information on the channel units is stored, and new signaling information is prevented from being transferred to the channel units. The result of the signaling state storage is that the channels remain in their present state (busy or idle) until trunk processing is initiated. This prevents the dropping of calls during momentary and intermittent failures. If the active alarm source is the $\overline{\text{LCA}}$ bus or a card out loop, the LCA LED (red) is turned on.

3.06 If the active alarm source is a TPA unit power failure, the ABS relay (K7) is deenergized by the power fail circuit. When the ABS relay is deenergized, the −48V supply to the unit and the −48 SIG supply to the channel units are replaced by −48 ABS. In addition, −48 ABS is switched into the regulator, which provides the −5V supply to the unit. A contact of the ABS relay provides a ground to the reset circuit, which forces the microprocessor to begin the trunk-processing routine. During TPA unit power failures, power to all LEDs, except the TPAF LED, is removed.

3.07 After an alarm source is detected, the microprocessor continues checking the source. If a solid alarm condition persists for 2.5 seconds (or 450 milliseconds, optional) of hit integration, the microprocessor will initiate trunk processing. This interval is determined by the OPTION X lead, which is a strapping option on the backplane of the multiplex shelf. If intermittent alarm conditions persist for at least 20 percent of the time, hit integration ensures that trunk processing will eventually occur. For example, an intermittent error condition, consisting of a repetition of a 0.5-second error condition followed by a 0.5-second no error condition, will cause trunk processing in approximately 6.25 seconds with the 2.5-second option selected.

3.08 The microprocessor initiates trunk processing by energizing the CGA relay (K3) and the CGA WINK relay (K2). When operated, the CGA and CGA WINK relays provide grounds to the channel units for disconnect/make-busy routines. At the same time that the CGA and CGA WINK relays operate, the following events occur:

(a) The microprocessor deenergizes the E2/ESS relay (K4) to notify external alarm reporting systems of the carrier failure.

(b) The microprocessor deenergizes the AUD/VIS relay (K6) to activate the audible and visual alarms in the central office (C.O.) alarm system.

(c) The TRMT lead to the TLU goes open, causing the TLU to send a remote alarm condition to the far end.

(d) The $\overline{\text{LOCKOUT}}$ lead goes low to enable the shift and 1 kHz functions in the RLU.

(e) The TPA lamp (red) is turned on.

3.09 The CGA DELAY relay (K1) is energized by the microprocessor 2.5 ±0.5 seconds (or 10 ±0.5 seconds, optional) after the CGA relay operates. This time

is determined by the OPTION Y lead, which is a strapping option on the backplane of the multiplex shelf. When the CGA DELAY relay is operated, an additional ground is provided to the channel units for disconnect/make-busy routines. At the same time the CGA DELAY relay is energized, the CGA WINK relay is deenergized for 70 ± 20 milliseconds to provide a wink pulse to the channel units. Following the wink pulse, the CGA WINK relay is again energized and the CGA counter is incremented.

3.10 If the local alarm source is a TPA unit power failure, following the wink pulse, the microprocessor energizes the POWER FAIL relay (K5). When the POWER FAIL relay is energized, the −5V supply to the unit is removed. In addition, a contact of the POWER FAIL relay supplies a ground to keep the CGA relay, CGA WINK relay, CGA DELAY relay, and POWER FAIL relay operated.

3.11 When the active alarm source is cleared, and no other local alarm sources are pending, the LCA LED is turned off (if it was on). If the alarm source was a TPA unit power failure, the ABS relay is energized, the POWER FAIL relay is deenergized, and the SIG UPDATE lead goes low to allow normal transfer of signaling information to the channel units. Approximately 12.46 seconds after the alarm source clears, the CGA, CGA WINK, and CGA DELAY relays are deenergized, which removes the grounds to the channel units. At the same time, the following events occur:

(a) The TPA lamp is turned off.

(b) The E2/ESS relay is energized, removing the alarm condition from external alarm/maintenance systems.

(c) The AUD/VIS relay is energized (if not already energized by the ACO pushbutton switch), which removes the alarm condition to the C.O. alarm system.

(d) The TRMT lead goes low to stop remote alarm transmission, which allows automatic reset of the far-end terminal.

(e) The $\overline{\text{LOCKOUT}}$ lead goes high to inhibit the shift and 1 kHz functions in the RLU.

3.12 If another local alarm source is pending when the active alarm source is cleared, trunk processing does not terminate. Instead, the pending local alarm source takes control of trunk processing. If the remote alarm source is pending when the local alarm source is cleared, and no other local alarm sources are pending, trunk processing continues under the control of the remote alarm source.

REMOTE ALARM

3.13 The unit recognizes one source of a remote alarm: the $\overline{\text{RRMT}}$ lead from the RLU. The $\overline{\text{RRMT}}$ lead goes low to indicate an alarm condition at the far end to the TPA unit.

3.14 Timing for a remote alarm is described in the following paragraphs (3.15 through 3.19) and shown in Fig. 4.

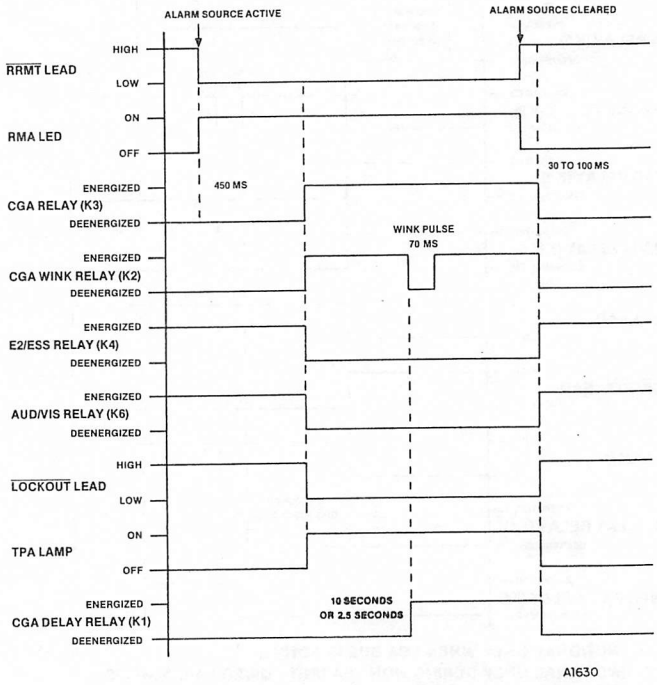


Fig. 4—Remote Alarm Timing

3.15 When the unit recognizes the remote alarm source ($\overline{\text{RRMT}}$ lead low), the RMA LED (yellow) turns on. The microprocessor begins the remote alarm trunk-processing routine by energizing the CGA relay and the CGA WINK relay 450 ± 50 milliseconds after the $\overline{\text{RRMT}}$ lead goes low. When operated, the CGA and CGA WINK relays provide grounds to the channel units for disconnect/make-busy routines. At the same time that the CGA and CGA WINK relays operate, the following events occur:

(a) The microprocessor deenergizes the E2/ESS relay to notify external alarm reporting systems of the carrier failure.

(b) The microprocessor deenergizes the AUD/VIS relay to activate the audible and visual alarms in the C.O. alarm system.

(c) The $\overline{\text{LOCKOUT}}$ lead goes low to enable the shift and 1 kHz functions in the RLU.

(d) The TPA lamp is turned on.

3.16 The CGA DELAY relay is energized by the microprocessor 2.5 ±0.5 seconds (or 10 ±0.5 seconds, optional) after the CGA relay operates. This time is determined by the OPTION Y lead, which is a strapping option on the backplane of the multiplex shelf. When the CGA DELAY relay is operated, an additional ground is provided to the channel units for disconnect/make-busy routines. At the same time the CGA DELAY relay is energized, the CGA WINK relay is deenergized for 70 ±20 milliseconds to provide a wink pulse to the channel units. Following the wink pulse, the CGA WINK relay is again energized and the CGA counter is incremented.

3.17 If the far-end terminal is looped while it is in alarm, the $\overline{\text{ALL1S}}$ lead from the line interface (LI-) unit goes low, causing the LCA LED to turn on. This is the only condition that causes both the LCA and RMA LEDs to turn on.

3.18 When the remote alarm is cleared ($\overline{\text{RRMT}}$ lead goes high), and no local alarm sources are pending, the RMA LED is turned off. Between 30 and 100 milliseconds after the alarm source is cleared, the CGA, CGA WINK and CGA DELAY relays are deenergized, which removes the grounds to the channel units. At the same time, the following events occur:

(a) The TPA lamp is turned off.

(b) The E2/ESS relay is energized, which removes the alarm condition from external alarm/maintenance systems.

(c) The AUD/VIS relay is energized (if not already energized by the ACO pushbutton switch), which removes the alarm condition to the C.O. alarm system.

(d) The $\overline{\text{LOCKOUT}}$ lead goes high to inhibit the shift and 1 kHz functions on the RLU.

3.19 If a local alarm source is pending when the remote alarm source is cleared, the local alarm source takes control of trunk processing.

TPA UNIT FAILURE

3.20 Once every two milliseconds, the microprocessor performs its own self-test. If the microprocessor passes the test, a pulse is provided to the TPA fail circuit. If the microprocessor fails the test, no pulse is applied to the TPA fail circuit, which then applies a reset signal to the reset circuit. The reset circuit applies a reset pulse to the microprocessor in an attempt to reestablish normal program execution. If the failure condition persists, the TPA fail circuit disables microprocessor control of the AUD/VIS relay. After a delay, the TPAF LED (red) is turned on and the AUD/VIS relay is deenergized by the TPA fail circuit, which operates the audible and visual alarms in the C.O. alarm system.

ACO

3.21 If, during trunk processing, the ACO pushbutton switch is pressed, the AUD/VIS relay is energized, which cuts off the audible and visual alarms in the C.O. alarm system and turns on the ACO LED (green). A strapping option on the backplane of the multiplex shelf (OPTION Z1 and OPTION Z2 leads) allows only the audible alarm to be cut off. The ACO LED turns off when the CGA is cleared.

LOOPING

3.22 The digroup (in Modes 2, 3, or 4) or the terminal (in Mode 1) can be looped during trunk processing by pressing the LOOP pushbutton switch. This sends a signal to the LI- on the $\overline{\text{LT}}$ lead which causes the LI- to perform the looping. When the LI- has looped, the LOOP lead goes high, turning on the LOOP LED (green). The CGA cannot be cleared when the terminal or digroup is looped. Pressing the LOOP pushbutton switch, when the terminal or digroup is looped, will unloop the terminal or digroup. The terminal or digroup is inhibited from being looped when a CGA is not present. The FTP test points allow a CGA to be forced, which facilitates access to the looping circuitry.

CGA COUNTER

3.23 The CGA counter (Group -0 only) is provided to count carrier failures. The counter is incremented at the end of each wink pulse. If the TP MEM pushbutton switch has been pressed, the TP MEM LED (yellow) is turned on also. It remains on until the TP MEM pushbutton switch is again pressed. The TP MEM function is disabled if the switch is left released. A reset button is provided on the face of the counter to reset the counter to zero.

4. OPTIONS

4.01 This unit has no field-selectable options. However, there are options on the backplane of the multiplex shelf which affect the operation of this unit. Refer to Section ITTR-18-405 (for shelves mounted in 23-inch bays) or ITTR-18-406 (for shelves mounted in 19-inch bays) for option selection information on these options.

5. RESTRICTIONS

WARNING: This unit contains static-sensitive (NMOS) devices. Section ITTR-18-599 contains handling instructions for NMOS-equipped units.

6. TEST AND MAINTENANCE FEATURES

6.01 A description of the test and maintenance features of the unit is provided in Table A. Refer to Fig. 1 for the physical location of these features.

TABLE A

FEATURE	REF. DES.	FUNCTION
LOOP LED (green)	DS1	When on, indicates that the digroup is looped (either by pressing of LOOP pushbutton switch on unit or by inserting shorting plug in LOOP test points on LI-3).
TP MEM LED (yellow)	DS2	When on, indicates that trunk processing is taking place or has taken place; will turn on only if TP MEM pushbutton switch on unit is in on position (pushed in); will turn off only when TP MEM pushbutton switch is in off position (released).
ACO LED (green)	DS3	When on, indicates that the ACO pushbutton switch has been pressed to cut off office alarms.
LCA LED (red)	DS4	When on, indicates that the LCA bus is active (digroup in local alarm); may be caused by one of several types of failures.

TABLE A (CONT)

FEATURE	REF. DES.	FUNCTION
RMA LED (yellow)	DS5	When on, indicates that the far-end terminal is experiencing a local alarm and is sending remote alarm code (all bit 2s are zero). ***Note:*** If RMA and LCA LEDs are both on, it indicates that the far-end terminal is looped.
TPAF LED (red)	DS6	When on, indicates that the unit has failed.
TPA Lamp (red)	DS7	When on, indicates that trunk processing is taking place (digroup in alarm) or that a CGA bus has been pulled to ground (channel unit failure).
ACO Push-button Switch	S1	Cuts off office alarms when pressed during a CGA (turns on ACO LED).
TP MEM Pushbutton Switch	S2	When pressed during a CGA, turns on TP MEM LED to provide visual history of terminal failures.
LOOP Push-button Switch	S3	When pressed during a CGA, causes LI- to loop digroup (turns on LOOP LED).
FTP Test Points	TP1 and TP2	When shorting plug is inserted in test points, causes unit to go into trunk processing.
CGA Counter	MR1	Is incremented each time trunk processing is initiated.

7. TECHNICAL SUMMARY

7.01 A summary of technical specifications for the unit is given in Table B.

TABLE B

ITEM	SPECIFICATION
DC POWER	
Voltage	−5 ±0.25 Vdc; −42 to −56 Vdc; −42 to −56 Vdc ABS
Current	400 mA maximum at −5 Vdc; 115 mA maximum at −48 Vdc; 285 mA maximum (during alarm conditions only) at −48V ABS
ALARM RELAY CONTACTS MAXIMUM CURRENT	2A
OPERATING ENVIRONMENT	
Temperature	0 to +55°C
Humidity	To 95% at 40°C (no condensation)
Altitude	To 14,000 ft (4,300 m)
DIMENSIONS	
Height	5.0 in. (12.7 cm)
Widtht	1.6 in. (4.1 cm)
Depth	9.6 in. (24.4 cm)
WEIGHT	0.9 lb (0.4 kg)

8. REPLACEABLE PARTS

8.01 This unit has no field-replaceable parts.

9. REFERENCES

9.01 The engineering drawings noted in Table C were used in the preparation of this Section.

TABLE C

TYPE	DRAWING NO.
Assembly	628030-000
Schematic	628030-002

8.02 Related information on the unit may be found in the ITTR Sections referenced in Table D.

TABLE D

TITLE	SECTION NO.
Connectorized Multiplex Shelf (MS/WC7, MS/WC6, MS/C7 and MS/C6), 628001, 628005, 628011 and 628015 (For 23-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-405
Connectorized Multiplex Shelf (MS19/WC7, MS19/WC5, MS19/C7 and MS19/C6), 628003, 628008, 628013 and 628018 (For 19-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-406
Mode 1 Common Equipment — Installation and Pretest	ITTR-18-431
Mode 2 Common Equipment — Installation and Pretest	ITTR-18-432
Mode 3 Common Equipment — Installation and Pretest	ITTR-18-433